

REMARKS

In the office action, the Examiner:

- (1) rejected Claim 29 under 35 U.S.C. § 112;
- (2) rejected Claims 1, 2, 4-8, 11-14, 17-20, 24, 25, 59, 63, 66, and 73-75 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,369,400 issued to Haeberle et al. ("Haeberle") in view of U.S. Patent No. 6,467,345 issued to Neukermans et al. ("Neukermans");
- (3) rejected claims 3, 23, 26 and 61 under 35 U.S.C. § 103(a) as being unpatentable over Haeberle;
- (4) rejected claims 9, 10, 15, 16, 21, 22, 42, 64 and 65 under 35 U.S.C. § 103(a) as being unpatentable over Haeberle in view of Neukermans and further in view of U.S. Patent No. 6,593,677 issued to Behin et al. ("Behin"); and
- (5) rejected Claims 67, 69-72 and 81-84 under 35 U.S.C. § 103(a) as being unpatentable over Haeberle in view of Neukermans and U.S. Patent No. 5,606,447 issued to Asada et al. ("Asada").

Reconsideration and allowance of the rejected claims are requested.

I. Rejection Under 35 U.S.C. § 112

The Examiner initially rejected Claim 29 as lacking proper antecedent basis for "the package." Claim 29 should be dependent on Claim 28 rather than Claim 26, and has accordingly been so amended. Claim 28 was previously withdrawn in response to a restriction requirement, and Claim 29 is accordingly also hereby withdrawn from consideration.

II. Rejections Under 35 U.S.C. § 103

Independent Claim 1 was rejected as being unpatentable over Haeberle in view of Neukermans. Claim 1 is directed to an array of electro-magnetically actuated MEMS devices. Each of the MEMS devices includes: a mirror having a reflective surface; a gimbal structure for movably supporting said mirror about first and second axes; a first coil pair on the mirror for causing selective movement of the mirror about the first axis in the presence of a magnetic field; and a second coil pair on the mirror for causing selective movement of the mirror about the second axis in the presence of a magnetic field. Each of the first and second coil pairs substantially fills the area of the mirror covered by the reflective surface. This structure provides greater torque during mirror actuation.

Neither Haeberle, nor Neukermans teaches or suggests the feature of each of the first and second coil pairs substantially filling the area of the mirror covered by the reflective surface. Haeberle discloses in Figs. 1A and 5 electric coils 2 on a platform 1. The reference discloses a particular cross (i.e., "+") coil arrangement corresponding to a similar arrangement of magnets thereunder. This structure allows the platform weight to be lowered as Haeberle teaches that "all unused areas on the movable platform 1 are cut off in order to keep the mass as low as possible." (col. 5, lines 28-29). The platform 1, accordingly, also has this "+" shape to correspond to that of the coil arrangement.

Neukermans discloses in FIGURE 5A, to which the Examiner particularly refers, a torsional scanner with a central mirror 82, which is rectangular in shape. A coil 85 is formed on the "mirror 82 about the periphery thereof." (col. 11, lines 7-10). See also Fig. 5b.

This combination of the teachings of Haeberle and Neukermans is improper because there is no suggestion for it and, moreover, the references actually teach away

from the combination. If Neukermans's mirror were used in Haeberle's platform, Haeberle's coils, particularly in Fig. 5, would be placed on and would cover useful areas of the reflective surface of the mirror, which should make the mirror unusable for its intended purpose. This would, of course, teach away from the combination.

Even if the references are properly combinable, the combination would not meet the claim limitations. Recall that Haeberle teaches cross-shaped coils and platform. If Neukermans's rectangular shaped mirror were placed on top of the coils and platform, large areas at the four corners of the mirror would extend beyond the periphery of the platform, which as previously discussed, has been cut away to reduce weight. This combination, of the teachings of Haeberle and Neukermans would not meet the limitation of each of the first and second coil pairs substantially filling the area of the mirror covered by the reflective surface specified in Claim 1. The combination of Haeberle and Neukermans's coils would not substantially fill the area of the mirror covered by a reflective surface as required by the claim.

Claim 1 is therefore patentable over the cited references. Claims 2-11 and 73 depend on Claim 1 and are also patentable over the references.

Independent Claim 12 is directed to a magnetically actuated mirror array apparatus. Claim 12 includes the feature of each of said first and second coil pairs substantially filling the area of the mirror covered by the reflective surface. As noted above, the Haeberle and Neukermans references are not properly combinable, and even if so combined, they do not teach this feature. Claim 12 and dependent Claims 13-17 and 74 are therefore patentable over the cited references.

Independent Claim 59 also recites each of the first and second coil pairs substantially filling the area of the mirror covered by the reflective surface. Claim 59 and dependent Claims 60-66 are similarly patentable over the cited references.

The Examiner rejected independent Claim 23 as being obvious over Haeberle. Claim 23 is directed to a MEMS apparatus. Haeberle does not teach or suggest the claimed array of electromagnetically actuated MEMS devices arranged in rows on a substrate. Furthermore, Haeberle does not teach or suggest an array of magnets including magnets along each row of devices having a pole direction parallel to said substrate, and magnets between each row of devices having a pole direction perpendicular to said substrate such that said devices are within a magnetic field produced by said array of magnets. Haeberle discloses in Figs. 2 and 3, to which the Examiner refers, magnets 7.1 and 7.2 for interaction with the coils of one particular device. The reference does not disclose what type of magnet arrangement would be used if there were an array of such devices. Presumably, each of the devices would have the same magnet arrangement shown in Figs. 2 and 3. There would then be no magnets between each row of devices, much less having the particular pole direction claimed. The Examiner also refers to column 2, lines 22-40 for disclosing the claimed structure. However, this passage only describes the magnet arrangement for a particular device as shown in Figs. 2-3. There is not disclosure of any magnet arrangement for an array of devices, much less what is claimed. Claim 23 and dependent Claims 24, 25 and 75 are patentable over the references.

Independent Claim 26 is directed to an array of electromagnetically actuated MEMS devices. Haeberle discloses single devices; it does not describe the claimed array of MEMS devices arranged in rows and columns. In addition, Haeberle does not teach or suggest the claimed array of magnets of alternating polarities positioned in a plane parallel to a plane containing said array of MEMS devices such that each such device is within a magnetic field containing primarily field lines perpendicular to the plane of said array of MEMS devices. Claim 26 is thus patentable over the cited references.

The Examiner rejected Independent Claim 42 as being unpatentable over the combination of Haeberle, Neukermans and Behin. Claim 42 is directed to a magnetically actuated mirror array apparatus, which includes means for determining the angular deflection of a mirror about first and second axes. Neither Haeberle, nor Neukermans discloses or suggests such means for determining angular deflection. Behin discloses a combdrive electrostatic device for controlling movement of a rotating element. In col. 4, lines 46-52, to which the Examiner refers, Behin very briefly mentions a position sensor to control the angular position of the rotating element. Behin, however, is not properly combinable with either Haeberle. First, Behin and Haeberle are not analogous because Behin is directed to electrostatically actuated devices, and Haeberle is directed to magnetically actuated devices. Second, the combination of teachings is simply an impermissible hindsight reconstruction of the Applicant's invention from pieces of the prior art; there is no suggestion in the references for combining Behin's position sensor in Haeberle's device, nor would it be apparent to one skilled in the art on how to modify Haeberle's device to include Behin's position sensor. Claim 42 is thus patentable over the cited references.

Independent Claim 67 is directed to an electro-magnetically actuated MEMS device. The claimed device features a mirror having a reflective surface; a gimbal frame for movably supporting said mirror about first and second axes; a first coil on the mirror; and a second coil on the gimbal frame, said first and second coils for causing selective movement of said mirror about the first and second axes in the presence of a magnetic field, said first coil substantially filling the area of the mirror covered by the reflective surface. The Examiner rejected this claim based on the combination of Haeberle, Neukermans, and Asada. Asada is cited for teaching in Fig. 10 a second coil 7A on a gimbal frame 5A. There is, however, simply no basis for combining this teaching with that of the primary reference Haeberle. Haeberle discloses, e.g., in Fig. 1A, four coils 2 placed on a movable platform 1. The platform is

supported by four thin, movable suspension elements 4, which elastically support the platform. The four suspension elements are completely separate from each other and operate independently. If the teachings are combined in the manner suggested by the Examiner, Asada's second coil 7A, which extends almost completely around the gimbal frame 5A, would be placed on Haeberle's four separate suspension elements 4. Since the suspension elements do not contact each other, the second coil would have to physically bridge the suspension elements. It is unclear how the coil could be placed on the thin suspension elements, but even if it were somehow possible to do this, the coil would likely impair the operation of the independent elements. One skilled in the art would thus have no reason to consider making such a modification. Claim 67 and dependent Claims 68, 81 and 82 are thus patentable over the cited references.

Independent Claim 69 requires a first coil on a mirror and a second coil on a gimbal frame. Claim 69 is also patentable over the cited references. Claim 69 and dependent Claims 70-72, 83 and 84 are patentable over the cited references.

Claims 1-26, 42, 59-75 and 81-84 are pending in the present application. As the application is now believed to be in condition for allowance, issuance of a Notice of Allowance is respectfully requested.

The Commissioner is hereby authorized to charge any fee deficiency associated with this submission, or credit any overpayment to Deposit Account No. 08-0219.

Respectfully submitted,



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